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High-Gum-Yielding Slash Pines Survive and Grow Well

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ABSTRACT.--Plantings in Georgia and Florida were established with slash pine seedlings of three genetic types: selections improved for high gum yield (IHGY), selections with improved growth and form (IGF), and commercial stock (CS). Under adverse environmental conditions in Florida, IHGY survived best at age 3, CS next best, and IGF poorest. Survival was more than twice as high in Georgia at age 4; it was uniformly high except for IGF seedlings from one nursery. Significantly more fusiform rust was found in CS than in IHGY or IGF stock. IHGY had 44.8 percent more volume than CS at age 10; no 10-year-old IGF were available for comparison.

Keywords: *Pinus elliotii*, tree improvement, commercial stock, growth and yield, survival.

In the mid-1970's, reduced survival in young slash pine (*Pinus elliotii* Engelm.) plantations caused by hot summers or other unknown factors led to concerns about the survivability of specially bred selections of the species. The objective of the study described here was to compare survival and early growth of three genetic types of slash pine: improved high gum yielders (IHGY), selections improved for growth and form (IGF), and commercial stock (CS). Stock was obtained from three nurseries, and growth was observed in three field plantings.

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METHODS

IHGY, IGF, and CS seedlings were obtained from the Florida Division of Forestry's Munson Nursery; IHGY and IGF from the Georgia Forestry Commission's Reidsville Nursery; and CS from the Florida Division of Forestry's Andrews Nursery. Seedlings were planted by hand near Soperton, Georgia, in February 1977 and by machine near Live Oak, Florida, in December 1977. The Live Oak site had previously been a soybean field; the Soperton site had been occupied by pines which were clearcut. Logging slash was piled and burned, and low beds were made at Soperton. At both sites, trees were planted at a 1.83- by 3.66-m spacing in 12 randomized blocks with 52 seedlings per source. In all, 3,844 seedlings were planted at each location. Survival and total height were observed at both locations in the late fall of 1980.

Occurrence of fusiform rust was recorded only in Georgia since very few trees were infected in Florida. Survival percentages were transformed by arc sine, and both height and survival data were subjected to analysis of variance.

The 10-year-old plantation was machine planted in 1968 on the Osceola National Forest in Florida on beds 4.5 m apart. Spacing on beds was 3.6 m. High-gum-yielding tree seeds were obtained from the U.S. Forest Service McColskey Still seed orchard. Volume was calculated using the formula $\text{ft}^3 = 0.02408 + 0.0021058 (D^2H)$ and converted to m^3/ha . In December 1977, five (0.1 acre) plots were measured for height and d.b.h. Data were analyzed by an analysis of variance.

RESULTS AND DISCUSSION

Survival in the younger plantings through fall 1980 was significantly greater in Georgia than in Florida (table 1). In Florida the IHGY stock had the highest survival (38.8 and 44.4 percent) and IGF the lowest (25.6 and 29.0 percent). A severe drought during this year killed so many seedlings that the entire planting was a failure by commercial standards. Heights in Florida ranged from 1.35 to 1.52 m, and no significant differences attributable to planting stock were observed. In Georgia, survival ranged from 78.4 percent for CS seedlings from Munson, Florida, to 47.4 percent for the IGF trees from Reidsville, Georgia. Survival of the latter was significantly less than for any other group. Average height dif-

Table 1.--Performance of slash pine seedlings of three genetic types in a 4-year-old Georgia and a 3-year-old Florida plantation¹

Nursery location and genetic type of stock	Percent survival		Percent fusiform		Height	
	GA	FL	GA	FL	GA	FL
- - - m - - -						
FDF, Munson, FL:						
IHGY	72.7a	38.8ab	26.0b	--	2.85a	1.49a
IGF	68.9a	25.6b	23.3b	--	2.83ab	1.46a
CS	78.4a	34.4ab	34.4a	--	2.62ab	1.46a
GFC, Reidsville, GA:						
IHGY	75.7a	44.4a	20.8b	--	2.81ab	1.52a
IGF	47.4b	29.0b	24.8b	--	2.62b	1.45a
FDF, Andrews, FL:						
CS	75.0a	34.1ab	37.0a	--	2.7ab	1.35a

Within columns, means followed by the same letter do not differ significantly at the 0.05 level according to Duncan's new multiple range test.

¹Seedlings were produced in nurseries of the Florida Division of Forestry (FDF) and Georgia Forestry Commission (GFC). IHGY = improved for high gum yield; IGF = improved growth and form; CS = commercial stock.

ferred significantly among the selections in the Georgia planting, ranging from 2.62 to 2.85 m.

Although large differences in height among the three genetic types were not evident at ages 3 and 4, survival data indicated a clear superiority of the IHGY trees, especially in Florida under high stress conditions. In both locations the IGF stock had lower height growth, and these preliminary measurements indicate the IHGY may be superior to both CS and IGF stock.

Significantly more fusiform rust was found in the two groups of CS seedlings than in the IHGY or IGF stock. Apparently, selection of IHGY and IGF trees yielded some gain in resistance to fusiform rust. This gain is important because lower rust infection may translate into higher volume production at rotation age. Also, if fusiform rust was responsible for the low survival of the IGF trees, those surviving may be somewhat resistant to rust.

At age 10, volume of IHGY stock averaged 17.32 m³/ha, compared to 11.96

m³ for the CS (table 2). Survival for the IHGY was slightly less, but volume was 44.8 percent greater than for the CS stock.

These data confirm earlier observations that IHGY trees grow as well as ordinary commercial stock, if not better. A large volume advantage for IHGY stock was apparent by age 10. If commercial gum production is even a remote possibility, IHGY trees are obviously the best alternative for slash pine plantation establishment. IHGY trees are also an attractive alternative in other situations because they grow faster than most CS. Since 10-year tests did not include IGF trees, their value cannot be compared with that of IHGY at this time.

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Table 2.--Yields of improved high-gum-yielding (IHGY) and commercial stock (CS) of slash pine on the Osceola National Forest after 10 years of growth

Type of stock	Trees/ hectare	Mean height	Mean diameter	Volume
		<u>m</u>	<u>cm</u>	<u>m³/ha</u>
IHGY	524	8.07	11.45	17.32
CS	549	6.85	9.42	11.96
Percent difference		17.8*	21.6*	44.8**

* and ** indicate statistically significant differences at the 0.05 and 0.01 level, respectively.



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